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Farm context and winter grazing practices in the Waikato dairy industry

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Disclaimer

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Executive Summary

The influence of farm context on the winter grazing practices of dairy farmers in the Waikato is investigated in this report. Farm context is the set of factors in a farm system that influences the benefits to be had from adopting a particular management practice or technology (Kaine 2008). With regard to winter grazing by dairy farmers in the Waikato the key factors of interest are the influence of frequency and severity of soil pugging on management practices.

Versus Research Ltd and Davies (2012) quantified the use of winter grazing practices by dairy farmers in the Waikato region including the wintering off and standing off of stock. They then identified differences in the use of practices across districts, farm and herd size, stocking rates, soil types and demographics. They also classified respondents into segments based on differences in standoff practice (frequency and duration).

While Versus Research Ltd and Davies (2012) concluded that contextual factors such as the severity of pugging did influence the practice of standing off stock it was unclear how the various contextual factors <u>combined</u> together to influence the grazing practices of dairy farmers. How the various contextual factors combine to influence farmers' grazing management in winter is important for policy makers as this information is crucial to:

- Assessing the flexibility, if any, farmers may have in their choice of winter grazing practices
- Assessing the likely costs to dairy farmers of changing winter grazing practices.

In this report the data collected by Versus Research Ltd and Davies (2012) is re-analysed to more clearly show the link between the winter grazing practices of dairy farmers, specifically wintering off and standing off, and factors in the farm context such as frequency and extent of pugging and soil types. The results reported here complement those reported by Versus Research Ltd and Davies (2012).

The influence of these factors on management practices was analysed by (1) classifying farmers into farm context segments for standing off stock based on farmer's assessments of the proneness of their farm to pugging, and the extent of their farm that was pugged in a normal winter; and (2) classifying farmers into a second set of farm context segments for wintering off stock based on the size of their herd and their stocking rate.

The results confirmed that the practice of standing off dairy cattle in winter was driven by the proneness and extent of pugging that farmers experience over winter, and pugging was primarily a function of biophysical characteristics of the farm that influence drainage (such as soil type, rainfall, and farm topography). Put simply, dairy farmers who stand off stock in winter have farms that are prone to pugging, and pugging is relatively extensive. They also tend to have relatively high stocking rates.

In contrast, the main factors influencing wintering off were herd size, stocking rate, and proneness to pugging. Other factors such as district, soil type and extent of pugging were not significantly related to wintering off. Put simply, dairy farmers who winter off stock have relatively large herds and relatively high stocking rates. Their farms are also prone to pugging. These results indicate that farmers' decisions to winter off cattle are primarily influenced by the intensity of their farm systems and, to a lesser extent, the biophysical characteristics of their properties in relation to drainage.

The results indicated that wintering off and standing off in the dairy industry are motivated by different sets of factors in the farm system, though there is some overlap between these sets, and there are likely to be subtle interactions between farm infrastructure, standing off, and wintering off. These interactions create variety in the combinations of practices that farmers use to manage stock in winter, with the combination any one farmer uses being a function of the biophysical characteristics of their farm as well as high-level strategic decisions.

The variety in winter grazing management was summarised into five winter grazing systems for dairying. Given the Versus Research Ltd and Davies (2012) sample is representative of dairy farmers across the Waikato region these five systems, based on stand off practice, wintering off practice and farm infrastructure, represent the main types of winter grazing management systems used by dairy farmers in the Waikato.

In conclusion, the adoption of practices such as wintering off and standing off is motivated by production benefits and these benefits arise from the biophysical characteristics of dairy farms, herd size and stocking rates. This means that farmers that use these practices are likely to suffer serious economic losses should they be prevented from using them in the future. Conversely, farmers that do not use these practices are likely to suffer serious economic losses should they be compelled to use them in the future.

Introduction

The influence of farm context on the winter grazing practices of dairy farmers in the Waikato is investigated in this report. Farm context is the set of factors in a farm system that influences the benefits to be had from adopting a particular management practice or technology (Kaine 2008).

The Waikato Regional Council commissioned a telephone survey on dairy grazing management practices based on qualitative research by Davies and Topperwien (2011)[1]. The survey sought information on farmers' winter grazing practices and management decision in order to better understand the impact of these practices and decisions on nutrient emissions from farms. Davies and Topperwien (2011) investigated the winter grazing practices of dairy farmers and classified farmers into segments based on their standoff and wintering practices. Versus Research Ltd conducted the survey of a random sample of dairy farmers in the Waikato region in September 2011. The final sample consisted of 401 dairy farmers.

Versus Research Ltd and Davies (2012) quantified the use of winter grazing practices by dairy farmers in the Waikato region including the wintering off and standing off of stock. They then identified differences in the use of practices across districts, farm and herd size, stocking rates, soil types and demographics. They also classified respondents into segments based on differences in standoff practice (frequency and duration). The research reported here confirmed and quantified the proportion of famers in each segment identified by Davies and Topperwien (2011) and checked for the presence of other segments.

While Versus Research Ltd and Davies (2012) concluded that contextual factors such as the severity of pugging did influence the practice of standing off stock it was unclear how the various contextual factors <u>combined</u> together to influence the grazing practices of dairy farmers. How the various contextual factors combine to influence farmers' grazing management in winter is important for policy makers as this information is crucial to:

- Assessing the flexibility, if any, farmers may have in their choice of winter grazing practices
- Assessing the likely costs to dairy farmers of changing winter grazing practices.

In this report the data collected by Versus Research Ltd and Davies (2012) is re-analysed to show more clearly the link between the winter grazing practices of dairy farmers, specifically wintering off and standing off, and factors in the farm context such as proneness and extent of pugging and soil types. The results reported here complement those reported by Versus Research Ltd and Davies (2012).

The influence of these factors on management practices was analysed by (1) classifying farmers into farm context segments for standing off stock based on

[1] Similar research has been conducted on sheep and beef enterprises. See Davies (2012), Versus Research Ltd and Reed (2014) and Kaine (2014).

farmer's assessments of the proneness of their farm to pugging, and the extent of their farm that was pugged in a normal winter; and (2) classifying farmers into a second set of farm context segments for wintering off stock based on the size of their herd and their stocking rate.

I hypothesised that, because the proneness and extent of pugging would differ across the farm context segments, the stand off practices farmers employed during winter would differ across the segments. I also hypothesised that, because the grazing pressure would differ across the farm contexts, the wintering off practices farmers employed during winter would differ across the segments.

In the next section the classification of farmers into farm context segments for standing off is described. This is followed by an analysis of the differences among contexts in management practices. I then investigate and discuss differences in the factors that influence the decision to stand off and winter off. In the following section the classification of farmers into farm context segments for wintering off is described. The implications of the results are discussed briefly in the final section.

Farm context segments for standing off

Respondents to the Versus Research Ltd and Davies (2012) survey were classified into farm context segments for standing off stock in winter based on their assessments of:

- The proneness of their farm to pugging, and
- The extent of their farm that was pugged in a normal winter.

Proneness to pugging was rated by respondents on a four-point scale from not at all prone to very prone (Versus Research Ltd and Davies 2012, 11).

The extent of the farm subject to pugging in a normal winter was elicited as a percentage of the farm area (including trough areas and laneways) and graded into three categories; less than 5% typically pugged, 5% to 10% typically pugged, more than 10% typically pugged (Versus Research Ltd and Davies 2012, 12). We assumed the proportion of the farm that was subject to pugging was zero for those farmers that had reported their farms were not at all prone to pugging.

Respondents were classified into farm context segments using SPSS (IBM 2012). The classification method and measure of dissimilarity employed were Wards and squared Euclidean distance, respectively (Aldenderfer and Blashfield 1984). Examination of the agglomeration schedule indicated a substantial increase in the agglomeration coefficient at the formation of five segments; consequently a six-segment solution was selected for analysis (Aldenderfer and Blashfield 1984, 55-57).

The profiles of the farm context segments with respect to the proneness and extent of pugging are summarised in table 1. The location and characteristics of the farm contexts with respect to contour, drainage, and main soil type are reported in tables 2 and 3 respectively. The characteristics of the contexts in terms of farm infrastructure and grazing practices during winter are summarised in tables 4 and 5.[2]

Overall, an inspection of the tables reveals that differences in the proneness and extent of pugging across the farm contexts are associated with differences in contour, drainage and soil type. It also reveals that differences in the proneness and extent of pugging across the contexts are associated with differences in the kinds of infrastructure, such as feed pads and loafing pads on farms, and in the grazing practices used. The frequency of wintering off was not significantly different, statistically speaking, across the farm contexts. This is not surprising as the main reasons for wintering off were to manage pasture production (Versus Research Ltd and Davies 2012, 16). The factors influencing wintering off are considered in detail later in this report.

Each of the contexts is described in detail below.

[2] Note that only the results of overall significance tests are reported. The results of post-hoc and pairwise tests are available on request from the author.

Farm context one: Prone to extensive pugging

The farms with this context are prone or very prone to extensive pugging with approximately a quarter of the area of these farms being prone to pugging in winter, on average. Farms in this context have a flat topography and the soils are mainly clays or loams that have poor to moderate drainage (see figures 1, 2 and 3). Farms with this context are concentrated in districts in the north of the region.

A relatively high proportion of the farms in this context have feed pads, purpose built loafing pads, wintering barns or a herd home, and have sacrifice paddocks over winter (see figure 4). A relatively low proportion of farms in this context only had sheds and laneways.

Most farmers with this context stand off stock for more than 12 hours a day for at least ten days in winter. Most have to stand off stock for up to a month, some for even longer (see figure 5).

Farm context two: Very prone to some pugging

The farms with this context are very prone to pugging over a relatively small area, with approximately five per cent of the area of these farms being very prone to pugging in winter, on average. The farms in this context have a flat or flat to rolling topography and the soils are mainly clays and loams that have poor to moderate drainage. Farms with this context are concentrated in districts in the north of the region, like those with context one.

Similar to the farms in context one, a relatively high proportion of the farms in context two have feed pads, purpose built loafing pads, wintering barns or a herd home, and have sacrifice paddocks over winter. A relatively low proportion of farms in this context have only sheds and laneways.

As was the case with the farmers with context one, most farmers with context two stand off stock for more than 12 hours a day for at least ten days in winter. Most have to stand off stock for up to a month, some for even longer.

Farm context three: Prone to some pugging

The farms with this context are prone to pugging over a relatively small area, with approximately seven per cent of the area of these farms being prone to pugging in winter, on average. The farms in this context have a flat to rolling topography and the soils are mainly ash and loams that have good drainage. Farms with this context are spread throughout the region.

Similar to the farms in contexts one and two, a relatively high proportion of the farms in context three have feed pads, purpose build loafing pads, and have sacrifice paddocks over winter. A relatively low proportion of farms in this context have only sheds and laneways.

Unlike farmers with contexts one and two, most farmers in context three stand off stock for less than a month in winter.

Table 1: Farm context segments for standing off

	Context 1 Prone to extensive pugging	Context 2 Very prone to some pugging	Context 3 Prone to some pugging	Context 4 Prone to a little pugging	Context 5 Some occasional pugging	Context 6 Not prone to any pugging
Percentage of sample	11	17	22	14	14	22
Proneness to pugging*						
Very prone	55	100	-	-	-	-
Prone	38	-	100	100	-	-
Not very prone	7	-	-	-	100	83
Not at all prone	-	-	-	-	-	17
Extent of pugging*						
Less than 5%	-	33	-	100	-	100
5% to 10%	-	67	100	-	100	-
More than 10%	100	-	-	-	-	-
Average % of farm pugged in winter*	24.2 (15-60)	5.3 (0-10)	6.8 (5-10)	1.5 (0-4)	7.0 (5-10)	1.6 (0-4)

Notes: * Denotes statistically significant differences across contexts
Values are percentage of respondents in each context except where otherwise indicated
Values in parentheses are ranges

Table 2: Farm context for standing off and location*

	Context 1 Prone to extensive pugging	Context 2 Very prone to some pugging	Context 3 Prone to some pugging	Context 4 Prone to a little pugging	Context 5 Some occasional pugging	Context 6 Not prone to any pugging
Hauraki	14	16	11	16	14	5
Matamata-Piako	36	22	31	18	27	20
Otorohanga	-	14	11	8	10	14
South Waikato	2	2	10	10	10	19
Taupo	-	-	-	-	2	4
Thames-Coromandel	10	2	2	6	2	4
Waipa	7	16	13	24	15	12
Waikato	29	25	16	18	14	12
Waitomo	2	2	4	2	-	-
Rotorua	-	2	4	-	8	11

Notes: * Denotes statistically significant differences across contexts
Values are percentage of respondents in each context

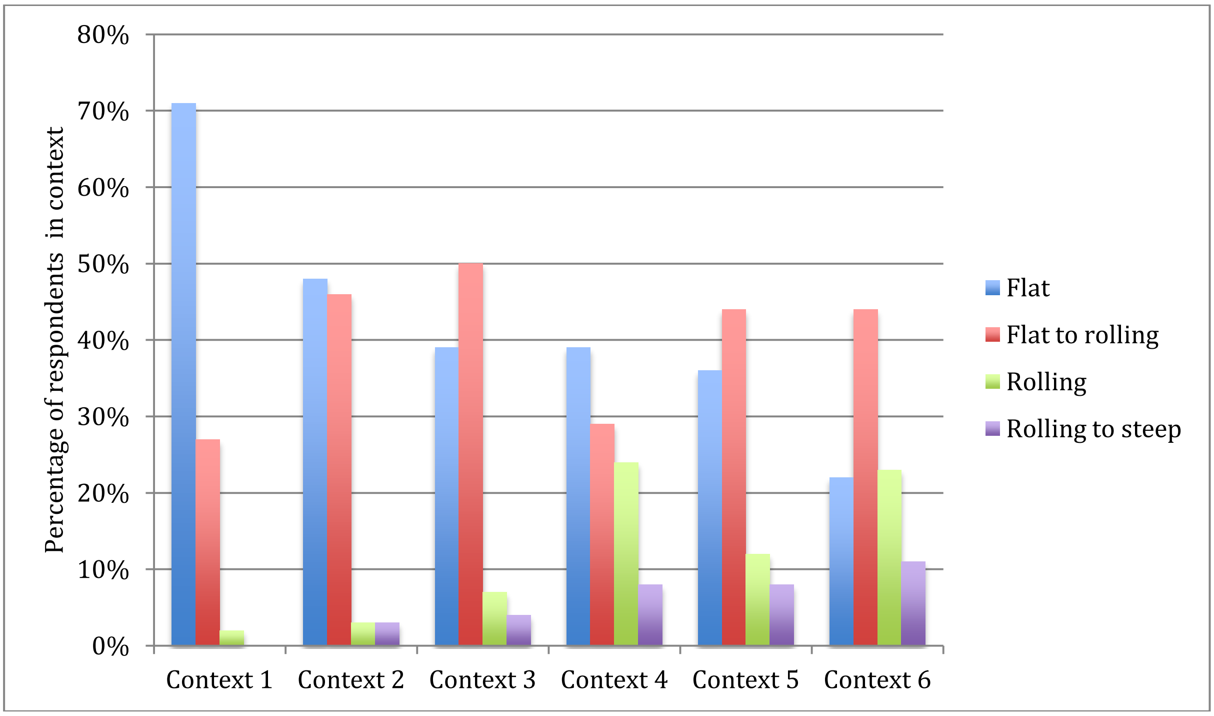

Figure 1: Farm context for standing off and topography

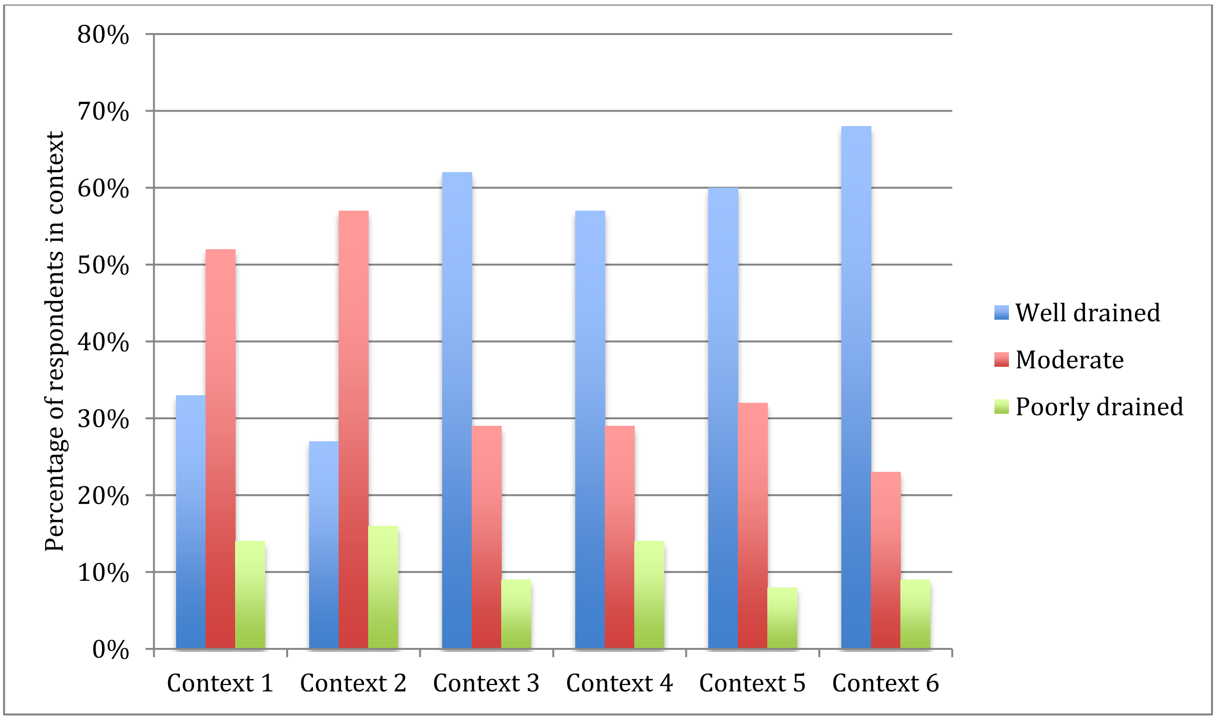

Figure 2: Farm context for standing off and drainage

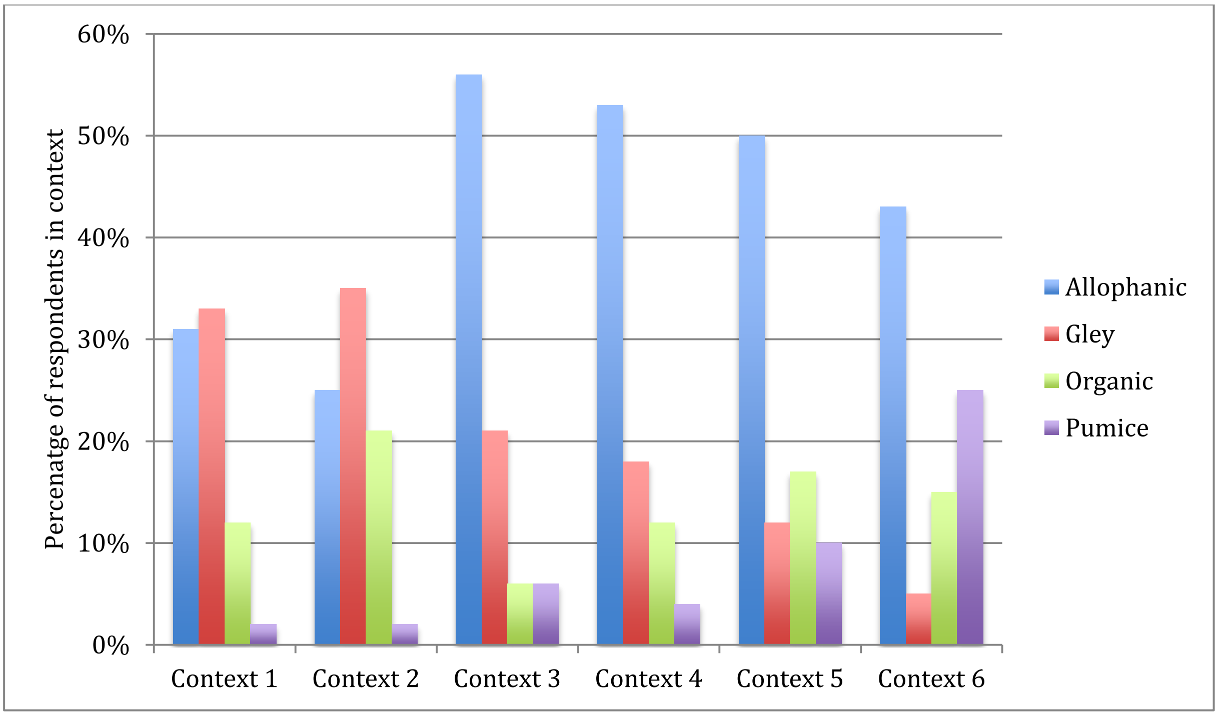

Figure 3: Farm context for standing off and soils

Table 3: Farm context for standing off and land characteristics

	Context 1 Prone to extensive pugging	**Context 2** Very prone to some pugging	**Context 3** Prone to some pugging	**Context 4** Prone to a little pugging	**Context 5** Some occasional pugging	**Context 6** Not prone to any pugging
Contour* Flat	71	48	39	39	36	22
Flat to rolling	27	46	50	29	44	44
Rolling	2	3	7	24	12	23
Rolling to steep	-	3	4	8	8	11
Drainage* Well drained	33	27	62	57	60	68
Mixed	52	57	29	29	32	23
Poorly drained	14	16	9	14	8	9
Soil type* Allophanic	31	25	56	53	50	43
Gley	33	35	21	18	12	5
Organic	12	21	6	12	17	15
Pumice	2	2	6	4	10	25
Soil description* Ash	24	32	54	47	42	49
Pumice	3	2	5	6	14	21
Loam	38	37	45	29	23	21
Peat	17	25	11	9	27	15
Clay	31	29	24	24	8	12
Marine clay	12	11	1	4	4	1

Notes: * Denotes statistically significant differences across contexts
Values are percentage of respondents in each context
Note that results are not reported for all not all soil types
Note that percentages may sum to more than 100 because respondents nominated more than one soil description

Farm context four: Prone to a little pugging
The farms with this context are prone to pugging over a very small area, with approximately two per cent of the area of these farms being prone to pugging in winter, on average. The farms in this context have a flat to rolling or rolling topography and the soils are mainly ash and loams that have good drainage. Farms with this context are spread throughout the region, like those with context three.

Similar to the farms in context one, a relatively high proportion of the farms in context four have feed pads, purpose build loafing pads, wintering barns or a herd home, and have sacrifice paddocks over winter. A relatively low proportion of farms in this context have only sheds and laneways.

Most farmers in context four stand off stock of for less than a month in winter.

Farm context five: Some occasional pugging
The farms with this context are a little prone to pugging over a relatively small area, with approximately seven per cent of the area of these farms being a little prone to pugging in winter, on average. The farms in this context have a flat to rolling or rolling topography and the soils are mainly ash, peat and loams that have mixed to good drainage. Farms with this context are spread throughout the region, although there is a relatively high proportion in the southern districts of the region.

Unlike the farms in the preceding contexts, a relatively low proportion of the farms in context five have feed pads and purpose build loafing pads. A relatively high proportion of farms in this context have only sheds and laneways.

Most farmers in context five stand off stock for less than ten days in winter.

Farm context six: Not prone to any pugging
The farms with this context are not prone to pugging at all, with approximately two per cent of the area of these farms being a little prone to pugging in winter, on average. The farms in this context have a flat to rolling or rolling topography and the soils are mainly ash, pumice and loam that have good drainage. Farms with this context, like those in context five, are spread throughout the region, although there is a relatively high proportion in the southern districts of the region.

Similar to the farms in context five, a relatively low proportion of the farms in context six have feed pads, purpose build loafing pads, and have sacrifice paddocks over winter. A relatively high proportion of farms in this context have only sheds and laneways.

Most farmers in context six either do not stand off stock or stand off stock for less than ten days in winter.

Table 4: Farm context for standing off and infrastructure

	Context 1 Prone to extensive pugging	Context 2 Very prone to some pugging	Context 3 Prone to some pugging	Context 4 Prone to a little pugging	Context 5 Some occasional pugging	Context 6 Not prone to any pugging
Feed pad*	21	33	24	35	15	17
Standoff or loafing pad*	43	27	29	18	15	9
Wintering barn or herd home*	10	10	4	6	4	0
Sacrifice paddock*	33	30	29	16	27	15
Only sheds and races*	33	24	27	37	48	62

Notes: * Denotes statistically significant differences across contexts
Values are percentage of respondents in each context

Table 5: Farm context for standing off and standoff practice

Standoff practice:	Context 1 Prone to extensive pugging	Context 2 Very prone to some pugging	Context 3 Prone to some pugging	Context 4 Prone to a little pugging	Context 5 Some occasional pugging	Context 6 Not prone to any pugging
Do standoff (1)*	88	95	84	88	74	53
Standoff segment (1)* Stand off < 10 days, < 12 hours	2	2	4	4	**20**	9
Stand off < 10 days, > 12 hours	7	8	**11**	**16**	**27**	**15**
Stand off 10-29 days, < 12 hours	10	10	**15**	**10**	4	5
Stand off 10-29 days, > 12 hours	**43**	**45**	**45**	**49**	**18**	**18**
Stand off > 30 days, < 12 hours	7	7	1	2	0	4
Stand off > 30 days, > 12 hours	**19**	**23**	9	6	4	1
Standoff for (2)* Less than 10 days	11	11	**17**	**23**	**62**	**44**
10-29 days	**60**	**58**	**71**	**67**	**32**	**47**
30-59 days	**16**	**25**	9	5	6	2
60-89 days	8	5	1	2	-	2
Every day	5	2	1	2	-	5

Notes: * Denotes statistically significant differences across contexts
(1) Values are percentage of respondents in each context. Values may not sum to percentage in context that stand off because of rounding errors
(2) Values are percentage of respondents that stand off in each context. Values may not sum to 100 because of rounding errors

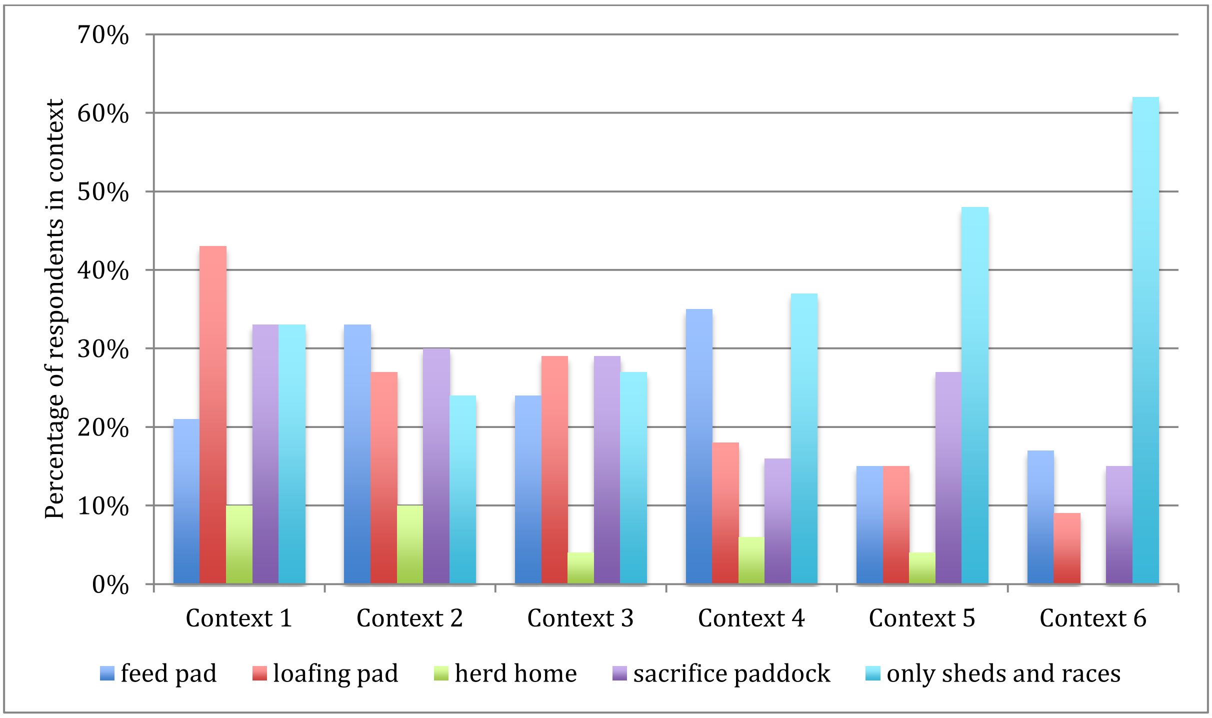

Figure 4: Farm context for standing off and infrastructure

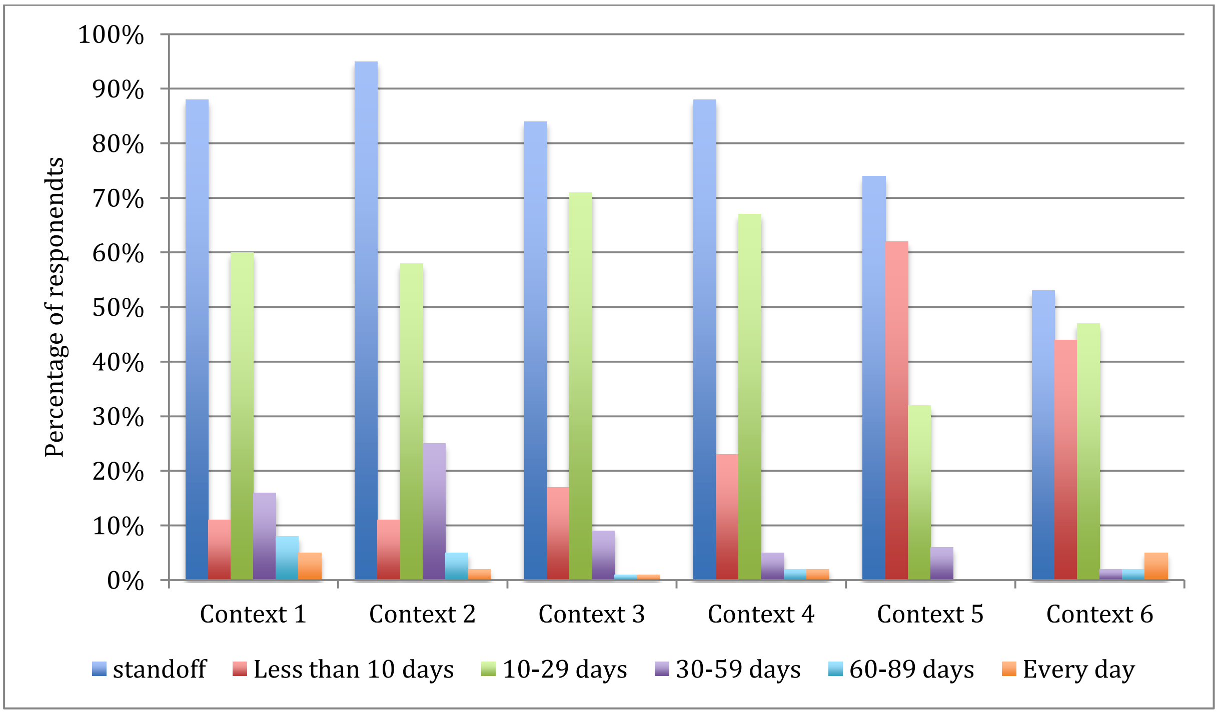

Figure 5: Farm context for standing off and stand off practice

Note: Values for standoff are percentage of respondents in context . Other values are percentage of respondents that stand off in each context.

Standing off and wintering off
Versus Research Ltd and Davies (2012) found the main reason for wintering off[3] dairy cattle was to manage pasture production and that only a small proportion of farmers wintered off to prevent pugging. This suggests that the factors that influence the decision to winter off dairy cattle are different to those that influence the decision to stand off dairy cattle. This suggestion was tested by using discriminant analysis (Klecka 1980) to identify the factors in the farm systems that were associated with standing off and wintering off dairy cattle.

The results of the analyses are summarised in table 6. Based on their correlation with the discriminating function the main factors influencing standing off stock were proneness to pugging and the extent of pugging, together with stocking rate. This is consistent with the results reported earlier and confirms that farmers' decisions to stand off cattle are primarily influenced by the biophysical characteristics of their properties that relate to pugging and, to a lesser extent, the intensity with which they farm.

Put simply, dairy farmers who did stand off stock in winter had farms that were prone to pugging, and pugging was relatively extensive. They also tended to have relatively high stocking rates. Farmers that did not stand off stock in winter had farms that were not prone to pugging and tended to have relatively low stocking rates.

In contrast, the main factors influencing wintering off were herd size, stocking rate, and proneness to pugging. Other factors such as district, soil type and extent of pugging were not significantly related to wintering off. These results indicate that farmers' decisions to winter off cattle are primarily influenced by the intensity of their farm systems and, to a lesser extent, the biophysical characteristics of their properties in relation to drainage. This is consistent with the reasons given by farmers for wintering off stock (Davies and Topperwien 2011).

Put simply, dairy farmers who wintered off stock had relatively large herds and relatively high stocking rates. Their farms were also prone to pugging. Farmers that did not winter off stock had relatively smaller herds and lower stocking rates. Their farms were not prone to pugging.

Farm context segments for wintering off

Given the results presented in the preceding section respondents to the Versus Research Ltd and Davies (2012) survey were classified into farm context segments for wintering off based on their:

- Herd size
- Stocking rate.

[3] Sending stock off the home farm for a period of time

Versus Research Ltd and Davies (2012) categorised farms into five groups based on herd size and six groups based on stocking rate.

As before, respondents were classified into farm context segments using SPSS (IBM 2012) and the classification method and measure of dissimilarity employed were Wards and squared Euclidean distance, respectively (Aldenderfer and Blashfield 1984). Examination of the agglomeration schedule indicated a substantial increase in the agglomeration coefficient at the formation of five segments; consequently a six-segment solution was selected for analysis (Aldenderfer and Blashfield 1984, 55-57).

The profiles of the farm context segments with respect to the herd size and stocking rate are summarised in table 7. The location of farm contexts is reported in table 8. Note that there were no statistically significant differences across the contexts in terms of contour, drainage and main soil type. The characteristics of the contexts in terms of farm infrastructure and grazing practices during winter are summarised in tables 9 and 10.

Each of the contexts for wintering off is described in detail below.

Farm context one: small farms with limited wintering off
The farmers with this context have relatively small herds and have medium stocking rates. Approximately 28 per cent of these farmers winter off their stock in June (see figure 6). Most farmers with this context also stand off stock in winter but usually for less than a month (see figure 7).

A relatively low proportion of the farms in this context have feed pads. A relatively high proportion of farms in this context have only sheds and laneways (see figure 8).

Farm context two: small farms with wintering off
The farmers with this context have relatively small herds but have relatively high stocking rates. Approximately 38% of these farmers winter off their stock in June and July. Most farmers with this context also stand off stock in winter, usually for ten days or more.

A relatively high proportion of the farms in this context have feed pads. A relatively low proportion of farms in this context have only sheds and laneways.

Farm context three: medium farms with limited wintering off
The farmers with this context have medium-sized herds but have relatively low stocking rates. Approximately 24% of these farmers winter off their stock in June. Most farmers with this context also stand off stock for up to a month in winter.

A relatively low proportion of the farms in this context have feed pads. A relatively high proportion of farms in this context have only sheds and laneways.

Table 6: Factors influencing standing off and wintering off

	Standing off*	**Wintering off***
Goodness-of-fit statistics Wilks' Lambda	0.87	0.95
Chi-square	50.8 (p<0.01)	18.6 (p<0.01)
Correlation coefficients Herd size	-	0.82
Stocking rate	-0.39	0.65
Proneness to pugging	0.94	-0.38
Pugging severity	-0.41	-
Classification statistics Correct prediction percentage	69	59

Notes: * Denotes statistically significant differences across contexts
Correlations less than 0.3 in absolute value are not reported.

Table 7: Farm context segments for wintering off

	Context 1 Small farms with limited wintering off	**Context 2** Small farms with wintering off	**Context 3** Medium farms with limited wintering off	**Context 4** Medium farms with wintering off	**Context 5** Large farms with wintering off	**Context 6** Large farms with extended wintering off
Percentage of respondents	24	21	16	12	22	7
Herd size*						
100-200	52	34	45	-	-	-
201-300	48	66	36	-	-	-
301-400	-	-	19	100	-	26
401-500	-	-	-	-	44	26
>500	-	-	-	-	56	48
Stocking rate*						
Less than 2.5	-	-	100	-	16	-
2.5 to 2.99	100	-	-	52	40	-
3.0 to 3.49	-	73	-	48	44	-
3.5 or more	-	27	-	-	-	100
Average farm size*	75.9 (35-120)	68.7 (34-100)	111.9 (41-340)	118.3 (94-156)	216.6 (126-776)	142.1 (73-350)
Average rainfall*	1301	1291	1395	1276	1278	1255

Notes: * Denotes statistically significant differences across contexts
Values are percentage of respondents in each context

Table 8: Farm context for wintering off and location*

	Context 1 Small farms with limited wintering off	**Context 2** Small farms with wintering off	**Context 3** Medium farms with limited wintering off	**Context 4** Medium farms with wintering off	**Context 5** Large farms with wintering off	**Context 6** Large farms with extended wintering off
Hauraki	13	11	21	13	10	-
Matamata-Piako	26	31	15	19	18	67
Otorohanga	12	10	7	13	12	4
South Waikato	10	12	7	10	8	7
Taupo	-	-	7	2	3	-
Thames-Coromandel	5	2	7	2	2	-
Waipa	12	15	16	13	16	15
Waikato	20	16	16	19	23	7
Waitomo	-	2	7	2	-	-
Rotorua	**3**	1	7	8	7	-

Notes: * Denotes statistically significant differences across contexts
Values are percentage of respondents in each context

Table 9: Farm context for wintering off and infrastructure

	Context 1 Small farms with limited wintering off	**Context 2** Small farms with wintering off	**Context 3** Medium farms with limited wintering off	**Context 4** Medium farms with wintering off	**Context 5** Large farms with wintering off	**Context 6** Large farms with extended wintering off
Feed pad*	10	27	10	27	33	59
Standoff or loafing pad*(1)	17	18	19	23	24	44
Wintering barn or herd home	3	6	2	10	3	7
Sacrifice paddock	25	24	31	29	26	15
Winter crops*	6	7	7	10	20	7
Only sheds and races*	55	39	47	33	30	11

Notes: * Denotes statistically significant differences across contexts
Values are percentage of respondents in each context
(1) Chi-square=10.5, p=0.06

Table 10: Farm context for wintering off and management practice

	Context 1 Small farms with limited wintering off	**Context 2** Small farms with wintering off	**Context 3** Medium farms with limited wintering off	**Context 4** Medium farms with wintering off	**Context 5** Large farms with wintering off	**Context 6** Large farms with extended wintering off
Do winter off [(1)*]	28	38	24	33	44	48
Winter off in [(2)] May	18	26	46	52	30	46
June	75	76	88	76	84	85
July*	36	76	54	45	68	69
August*	14	39	8	24	23	23
Winter off for [(2)*] Less than 10 days	35	30	42	19	16	4
10-29 days	54	56	44	50	66	74
30-59 days	7	6	11	22	13	13
60-89 days	3	5	2	3	-	9
Every day	-	3	-	6	4	-

Notes: * Denotes statistically significant differences across contexts
(1) Values are percentage of respondents in each context
(2) Values are percentage of those standing off in each context segment

Farm context four: medium farms with wintering off
The farmers with this context have medium-sized herds but have relatively high stocking rates. Approximately 33% of these farmers winter off their stock in June. Most farmers with this context also stand off stock in winter, usually for ten days or more.

A relatively high proportion of the farms in this context have feed pads, loafing pads or standoff pads, and winter crops. A relatively low proportion of farms in this context have only sheds and laneways.

Farm context five: large farms with wintering off
The farmers with this context have large herds and have medium stocking rates. Approximately 44 per cent of these farmers winter off stock in June and July and most also stand off stock in winter for up to a month.

A relatively high proportion of the farms in this context had feed pads, loafing pads or stand off pads, and winter crops. A relatively low proportion of farms in this context have only sheds and laneways.

Farm context six: large farms with extended wintering off
The farmers with this context had large herds and had very high stocking rates. Approximately 48 per cent of these farmers winter off stock in June and July and most also stand off stock in winter for up to a month.

A very high proportion of the farms in this context had feed pads and loafing pads. A very low proportion of farms in this context only had sheds and laneways.

These results confirm the findings from the discriminant analysis. The results indicate that wintering off and standing off in the dairy industry are motivated by different sets of factors in the farm system, though there is some overlap between the sets. They highlight the extensive variety in the combinations of practices that farmers use to manage stock in winter. They also highlight how the combination of practices any one farmer uses is a function of the biophysical characteristics of farms such as size, soil type and topography as well as management strategies such as stocking rates.

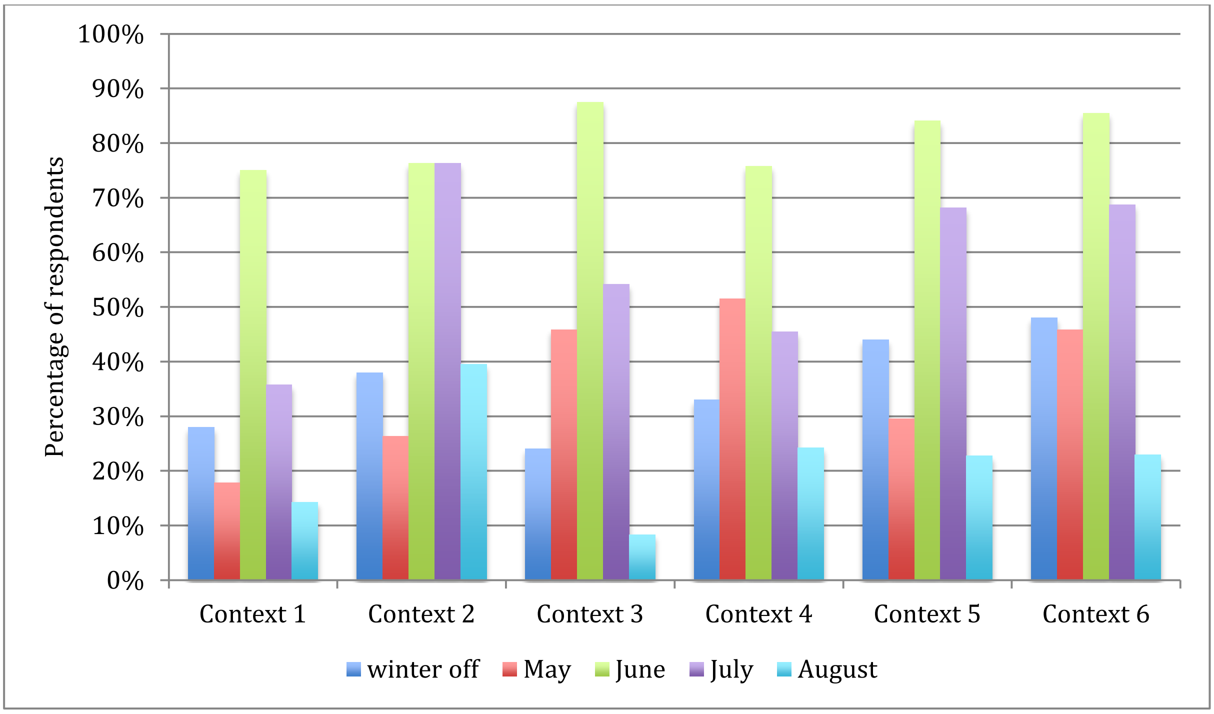

Figure 6: Farm context and wintering off

Note: Values for winter off are percentage of respondents in context . Other values are percentage of respondents that winter off in each context.

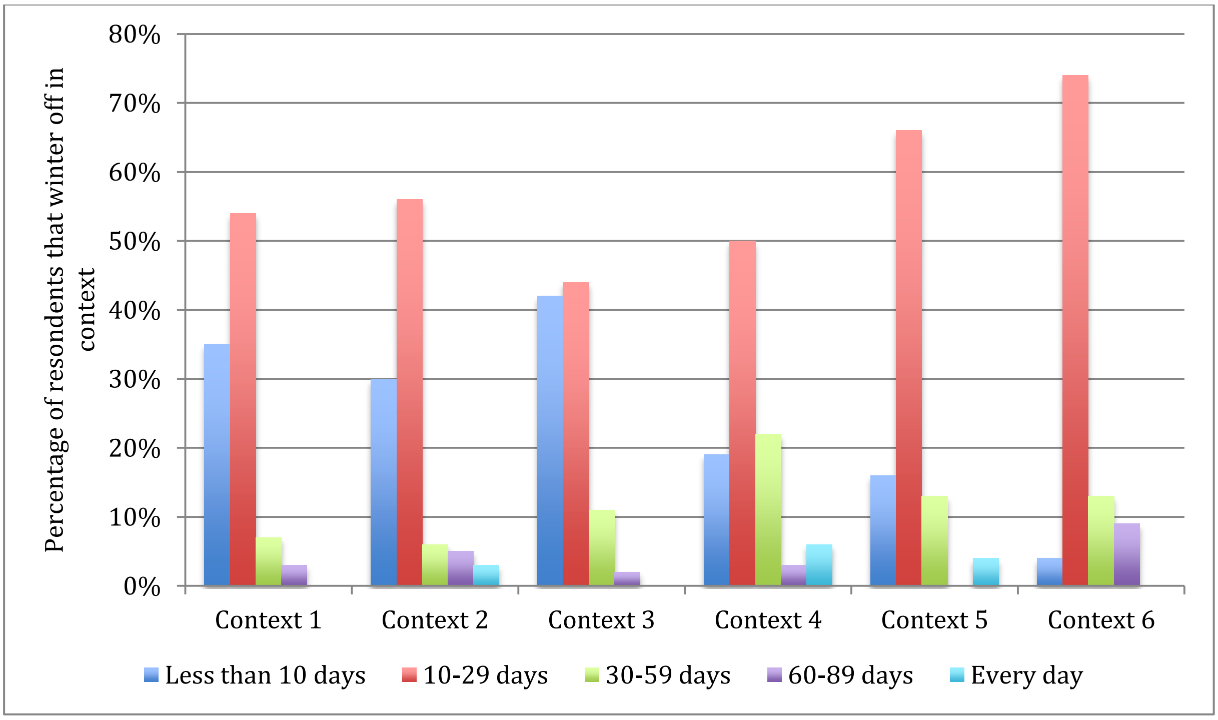

Figure 7: Farm context and wintering off practice

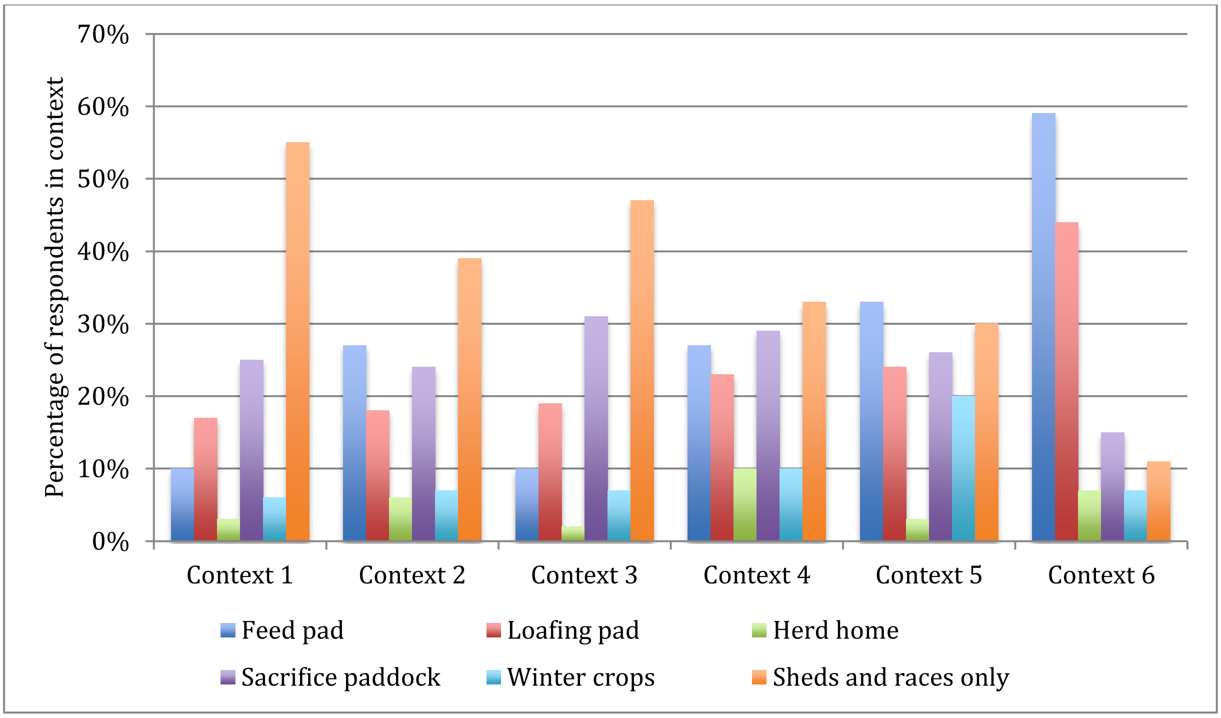

Figure 8: Farm context for wintering off and infrastructure

Table 11: Dairy farm wintering systems

	System 1	System 2	System 3	System 4	System 5
Description	Winter off, stand off using built infrastructure	Winter off, stand off using sacrifice paddocks	Winter off, stand off using stand off pads	Winter off, stand off using laneways	Don't winter off, stand off in laneways
Proportion of sample	24	20	17	12	27
Do winter off*	43	32	33	100	-
Stand off*	83	100	94	70	58
Feed pad*	71	21	15	-	-
Stand off pad*	23	0	100	-	-
Herd home*	18	-	3	-	-
Sacrifice paddock*	1	100	32	-	-
Sheds and yards only*	-	-	-	100	100
Herd size*	433 (120-1400)	338 (100-2300)	351 (128-880)	341 (100-2300)	264 (100-800)

Notes: * Denotes statistically significant differences across farm wintering systems
Values are percentage of respondents in each context except for average herd size
Values in parentheses are ranges

Conclusion

The results presented here confirm that the practice of standing off dairy cattle in winter is driven by the proneness and extent of pugging that farmers experience over winter. The proneness and extent of pugging is primarily a function of biophysical characteristics of the farm that influence drainage (such as soil type, rainfall, and farm topography). Other management decisions and practices do not appear to have any influence on stand off practice, except for stocking rate, which appears to have some, small influence.

The results indicate that wintering off and standing off in the dairy industry are motivated by different sets of factors in the farm system, though there is some overlap between these sets, and there are likely to be subtle interactions between farm infrastructure, standing off, and wintering off. These interactions create extensive variety in the combinations of practices that farmers use to manage stock in winter, with the combination any one farmer uses being a function of the biophysical characteristics of their farm as well as high-level strategic decisions.

These results, which are summarised in figures 9 and 10, lead to the conclusion that the adoption of practices such as wintering off and standing off are motivated by production benefits and these benefits arise from the biophysical characteristics of dairy farms, herd size and stocking rates.

The variety in winter grazing management was summarised into five winter grazing systems for dairying; which are reported in table 11. Given the Versus Research Ltd and Davies (2012) sample is representative of dairy farmers across the Waikato region these five systems, based on stand off practice, wintering off practice and farm infrastructure, represent the main types of winter grazing management systems used by dairy farmers in the Waikato.

Farm context factors such as soil type, location, susceptibility to and extent of pugging, herd size and stocking rate were significantly different across the five winter grazing systems. This means that farmers that use these practices are likely to suffer serious economic losses should they be prevented from using them in the future. Conversely, farmers that do not use these practices are likely to suffer serious economic losses should they be compelled to use them in the future.

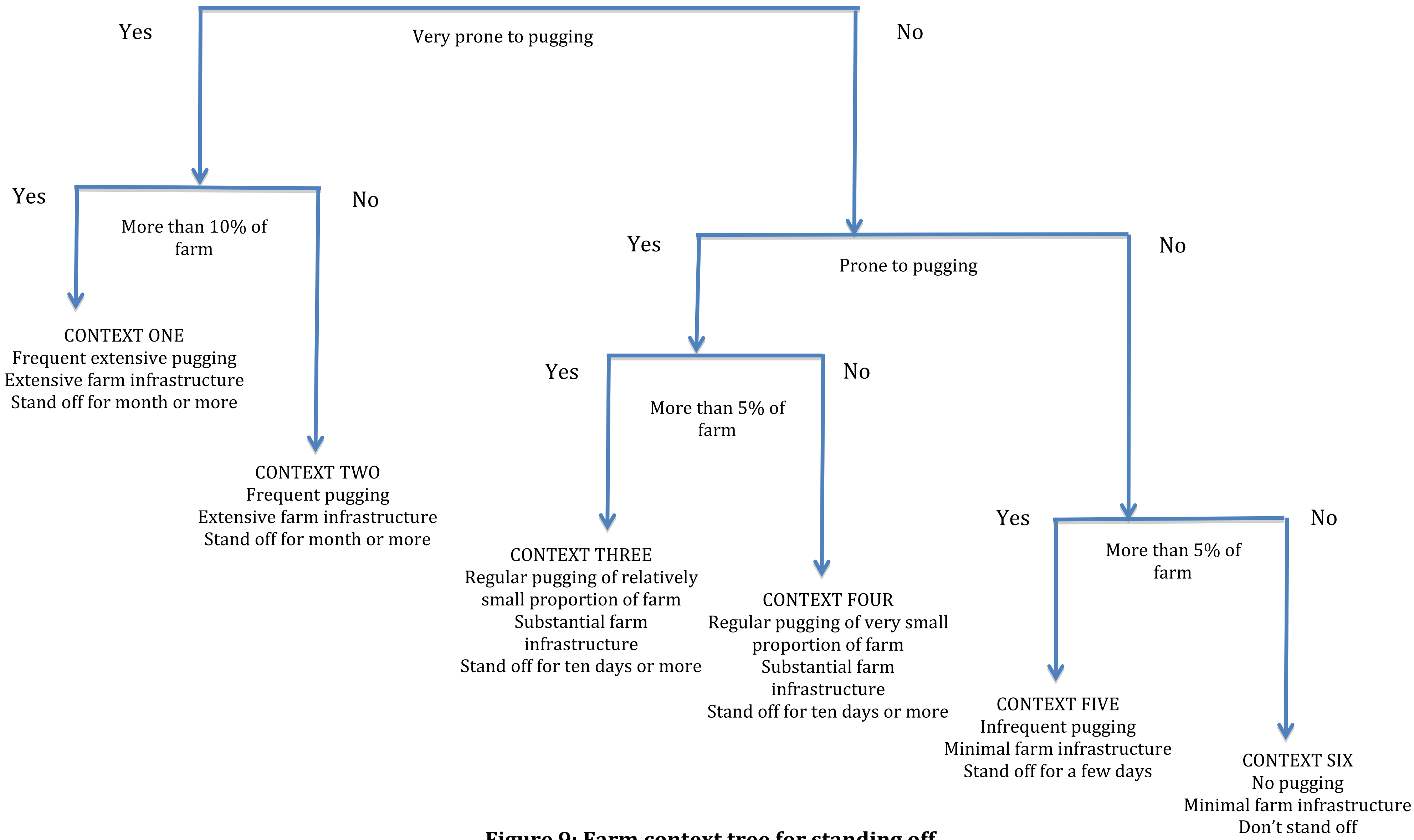

Figure 9: Farm context tree for standing off

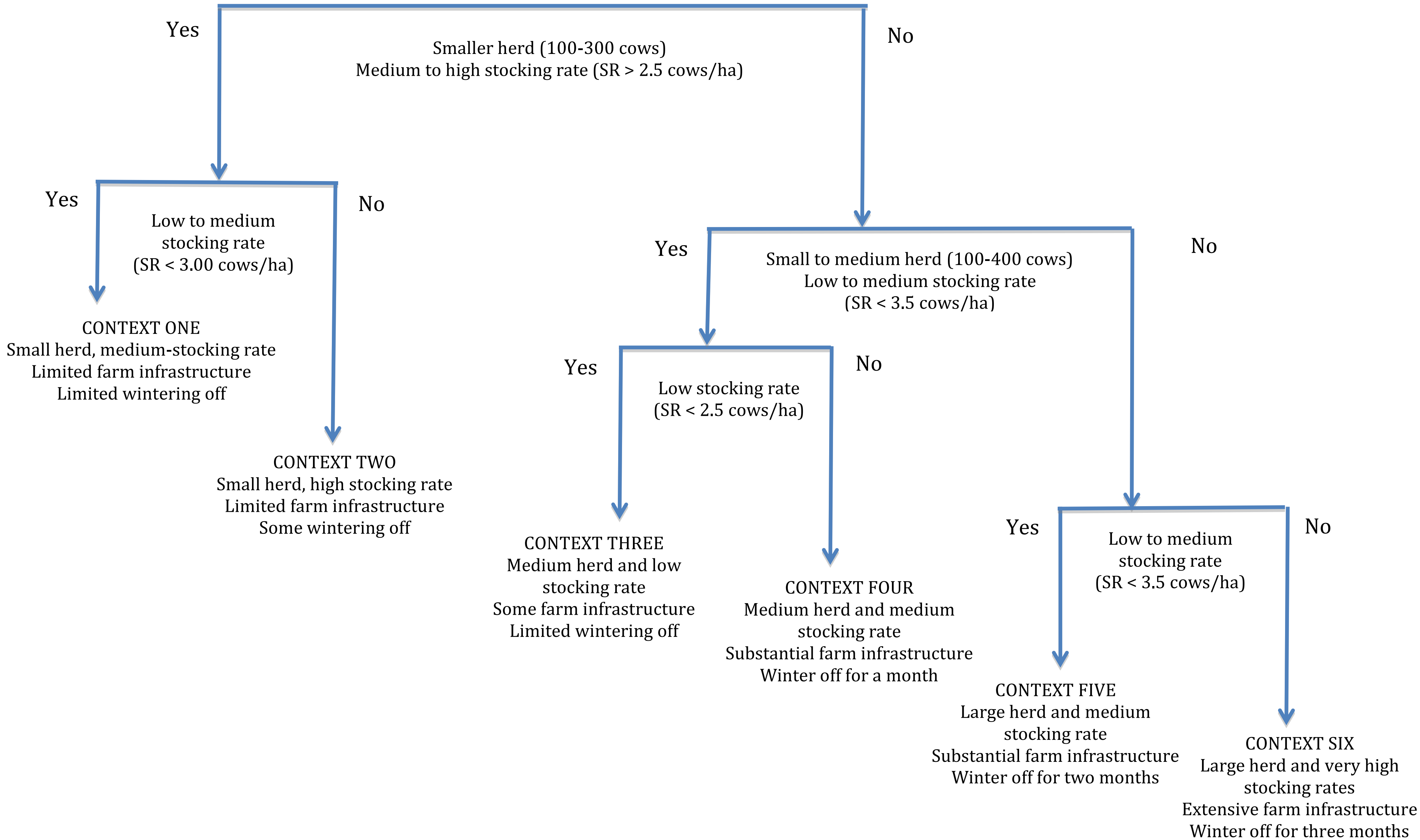

Figure 10: Farm context tree for wintering off

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